Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

if but a single square cm. on each glass face radiates toward m. As there are a number of such square cms., contributing radiation, the coefficient of (3) would be decreased ten or twenty times. One may conclude I think that $\Delta\theta$ compared with Δy_r is numerically much in excess. This implies too large a $\Delta\theta$, to persist in a room of practically constant temperature, in the summer. It is thus more than probable that at a vacuum of 10^{-3} mm. or a force of .22 dynes on each shot, so small a part as 10 or 20 times the $10^{-8} \times 70 \times \Delta y_r$ instanced in equation (1) may remain fluctuating in value with small changes in the radiating thermal environment.

Measurement of γ in Terms of the Viscosity of Air.—A maximum deflection of the m-balls is produced by placing the M-balls in position. When this is attained, the latter are reversed and the velocity v with which the needle (filamentary frame) passes through the equilibrium position, is measured with a stopwatch. The M-balls are then again reversed and the measurement of v repeated; etc. In a plenum, the motion of the needle through the zero point is practically uniform and therefore the frictional force is equal to the gravitational pull. Moreover, if two points of the scale near to and equidistant from the zero point are selected for releasing and arresting the stopwatch, the torsion of the fibre acts to the same degree as an acceleration and a retardation.

The frictional resistance encountered by either round mass m of radius r is by Stokes' equation $6\pi\eta rv$, where η is the viscosity of air. The velocity v of the balls m is

$$v = (l/2L)\,\Delta y/\Delta t$$

Δy is the telescopic excursion in the time Δt, symmetrically, to the position of equilibrium. We obtain in this way

$$\gamma = \frac{R^2}{Mm}\,\frac{3\pi\eta rl}{L}\,\frac{\Delta y}{\Delta t}$$

Work on this principle has been actively pursued, but the summer closed before it could be completed.

* Advance note from a Report to the Carnegie Institution of Washington, D. C.

PLANE REFLECTION OF SOUND, AS EXHIBITED BY THE PIN-HOLE RESONATOR*

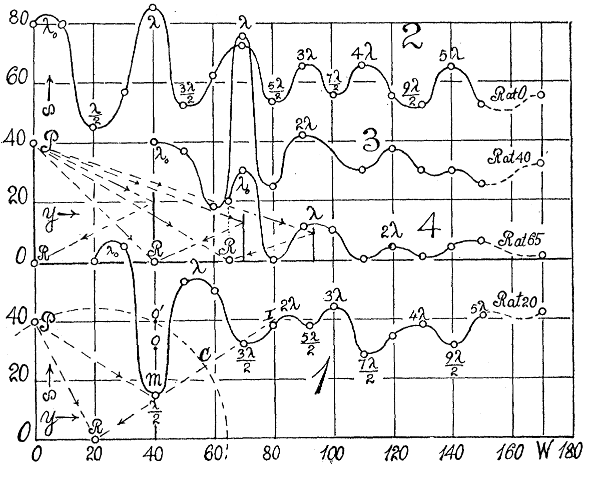
By C. Barus

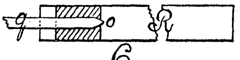
Department of Physics, Brown University

Communicated February 24, 1922

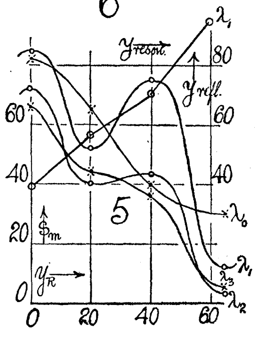
1. *Vertical Reflectors.*—These experiments, made between the walls of a room (y direction), with the closed organ pipe P, vertical, mouth down-

ward, at z = 40 cm. above the origin of the table, came out with surprising definiteness at once. They will therefore aid in disentangling the mysterious behavior of the resonator elsewhere observed (cf. *Science*). The resonator R, fig. 6, pin-hole tube qo, was placed on the table, horizontally, with the mouth toward the pipe (azimuth 270°). The vertical board or reflector 4 feet ×1 foot placed normal to y, was then moved successively from y = 20 cm. (about at the mouth of R) nearly to the wall W at y = 174 cm. The results are given in figure 1 where s is the fringe deflection of the U-tube interferometer. The chief maxima are near y = 50, 100, 150 cm., which suggests the wave-length of the f″ pipe λ = 48 cm., here operating by oblique reflection. Between the maxima λ and 3λ, there is a subsidiary maximum which one might erroneously attribute to overtones, inasmuch as it is often associated with weakly or strongly blown pipe notes. Thus at y = 80 the largest deflection is obtained from the dying note,





6



at 90 from a forced note; but the 2λ crest is regular. Distances between 150 cm. and the wall W at 174 cm., were not available. A remarkable feature of the curve is the strong initial minimum at y = 40 cm. If the board is placed more or less obliquely to y, the minimum tends to vanish, as shown by the successive tests at o' and o.

In the disposition given, two sound rays reach the resonator, one reflected from the board and the other direct, with immediate reflection from the table. When the board is near the mouth of the resonator, these rays are reduced to one and the result is an accentuated maximum. As the board distance in y increases, the path difference steadily increases with a simultaneous weakening of the reflected ray; nevertheless the figure proves conclusively that it is not as ineffective as one might suppose.

In contrast with the preceding, the next graph, figure 2, for the same pipe position, but with the resonator on the table at y = 0 cm. (in azimuth

180°) is more regular. The curve lies in higher values of s. There is less repetition of sectional groups. Nevertheless the same number of six maxima occur; i.e., each max. in figure 1 is reproduced and often accentuated in figure 2. The former minimum of $y = 40$ has shifted to a minimum somewhat above 20 cm.

The third survey in y was made with the pipe again at $z = 40$ cm. above the origin and with the resonator on the table (in azimuth 180°) at $y = 40$ cm. The graph, fig. 3, for the plate reflector normal to y and advancing along it shows the same number of maxima as heretofore, with the sixth soon to vanish. The feature of the curve is the enormously developed second maximum, in contrast with the first, or the others. We are no doubt trenching on the case of favorable incidence heretofore developed. The response was always stronger to the weak notes and they were used throughout, the difference being often over 10 scale parts, s.

Finally, figure 4 gives the corresponding acoustic distribution evoked by the advancing reflector with the pipe left in its former position, but with the resonator on the table at $y = 65$ cm. in azimuth 180°. The first maximum is now relatively high, while the former huge second maximum has flattened and the fifth and sixth maxima have vanished behind the wall. Weak notes were essential, as the strong notes gave relatively as little deflection, as before. As a whole, the present work adduces strikingly clear-cut evidence of the interferences to be identified in the following treatment; but it fails, as yet, to shed definite light on the anomalous distributions of intensity, s.

These maximum ordinates, s_m, for path-differences $\lambda = 0, \lambda, 2\lambda, 3\lambda$, are constructed for the corresponding resonator positions, y_r in figure 5. Compared with the regularly diminishing initial maximum, λ_0 the strongly harmonic s-distribution for the λ maximum, together with its decreasing amplitude are well brought out. Like λ_0, 2λ is but sparingly harmonic, while the odd 3λ is again markedly so. The graphs, fig 5, also contain the relation of the reflector and resonator positions in y, for λ_1 crests. The broken line should probably be straight, at an angle of about 50° to the vertical.

2. *Discussion of the Preceding Reflections.*—In the graphs 1 to 4, there are three influences at work on the resonator. In the first place the direct ray from the pipe is equivalent to a reflection from the table, a locus of reënforcement. A half wave-length has been lost. Then there are the two reflections, also with loss of $\lambda/2$, from the board normal to y and the wall W at $y = -130$ cm. This may be neglected, because it is always kept relatively very distant in the plan of the experiments. We thus have to compound the ray from the image of the source with the direct ray. The computation would be cumbersome; but the construction in the graph itself is not so and adequately correct. In figure 1, if the promi-

nent maxima or minima encountered during the march of the reflector in y, be taken, a circle is to be drawn with a center at R and a radius RP. In case of the first minimum at $y = 40$ cm., the image is I at $z = 40$, $y = 80$. Hence $IC = 27$ cm. is the path difference from the minimum at $y = 40$ cm. which is placed a little too high. The following data so measured, may be given as examples.

Minimum $y = 40$ cm., $\lambda/2 = 27$ cm. $y = 110$ cm., $7\lambda/2 = 179$ cm.
70 cm., $3\lambda/2 = 82$ $9\lambda/2 = 220$
93 cm., $5\lambda/2 = 126$
Maxima $y = 53$ cm., $1\lambda = 50$ cm. $y = 130$ cm., $4\lambda = 198$ cm.
83 cm., $2\lambda = 105$ 155 cm., $5\lambda = 248$
103 cm., $3\lambda = 148$ 25 cm., $0\lambda = 4$

These results in their entirety are convincing, being quite as accurate as the location of maxima and minima admits. The minima of figure 2 treated by the same method give, for instance,

Minimum $y = 25$ cm., $\lambda/2 = 24$ cm. $y = 103$ cm., $7\lambda/2 = 170$ cm.
50 cm., $3\lambda/2 = 68$ 126 cm., $9\lambda/2 = 215$
80 cm., $5\lambda/2 = 125$ etc.

with similar data for the maxima.

* Advance note from a report to the Carnegie Institution, Washington, D. C.

NOTE ON THE PROBLEM OF GREAT STELLAR DISTANCES

By Harlow Shapley

Astronomical Observatory, Harvard University

Communicated by Edwin B. Wilson, February 27, 1922

Through a study of the faint variable stars in the Small Magellanic Cloud it has been possible to check the photometric methods of measuring the parallaxes of globular clusters.

The great distances now ascribed to the globular systems require that the cluster type variables, with periods less than one day, be of high luminosity. The high absolute brightness of typical Cepheids, with periods longer than one day, is commonly accepted; but the faintness of the galactic variables of the cluster type, and their peculiarly large radial velocities, suggest that studies of their proper motions and trigonometric parallaxes will contribute little in the near future to the problem of their average absolute magnitude. It is now found, however, that the faintest variables in the Small Magellanic Cloud are Cepheids of the cluster type, and they are but one magnitude fainter than the typical Cepheids with periods of three days.

In 1904 and 1905 Miss Leavitt discovered nearly a thousand variable stars in the Small Magellanic Cloud from photographs made at Harvard's observing station at Arequipa, Peru. In addition, she found more than eight hundred variables in the Large Magellanic Cloud. Miss Leavitt